

**KEYSTONE BOILER**  
**ERIE POWER TECHNOLOGIES, INC.**  
**Technical Proposal**

## SECTION 1.0 BOILER

### 1.1 General

The "Keystone Boiler" design is an "O" Type Natural Circulation Industrial Water Tube Steam Generator. Its design configuration offers the least amount of furnace refractory compared to other designs. The tube and membrane seal welded front and rear walls virtually eliminate all refractory in the furnace, other than localized seals and refractory coverage of the water cooled burner throats. This design greatly reduces maintenance costs and offers increased unit availability. The furnace sidewalls are tube and membrane construction for the entire length of the furnace to eliminate the possibility of furnace gas bypass. The outer sidewalls are also tube and membrane design for gas tight construction. This design offers 100% water cooled walls and the ability to provide an extremely fast firing ramp rate.

The furnace wall tubes of any boiler encounter the highest heat flux. The Keystone, "O" type design has the shortest furnace wall tubes in the industry. This advantage removes heat from the furnace quickly and extends boiler life.

The "O" design has a single lower drum which reduces maintenance compared to other designs that may have two lower drums or headers. The single large diameter drum makes it easier to perform inspections and to maintain lower tube connections. The inherent symmetry of the "O" type design provides natural uniform circulation patterns and minimal gas side pressure drops in a space conserving easily handled and shipped configuration.

### 1.2 Heating Surfaces, Design Pressure and Size

• Furnace Radiant Heating Surface	760 Sq. Ft.
• Convection Heating Surface	5,415 Sq. Ft.
• Total Heating Surface	6,175 Sq. Ft.
• Furnace Volume	1,085 Cu. Ft
• Overall Width	11'-6"
• Overall Height	13'-11 1/4"
• Weld Line Length	22-1"
• Design Pressure/Operating Pressure	250 psig/125 psig

### 1.3 Drums

Submerged arc automatic welded and stress relieved with radiographed welded seams

- Drum material shall be SA-516 Gr. 70 or equal
- Tubes are rolled and expanded into the drum
- Drums are provided with a 12" x 16" manway access in each drum head

#### Upper (Steam) Drum

- Inside diameter is 42 inches. (Note: Larger than specified)
- All connections larger than 2" are to be flanged.
- External connections consist of the main steam outlet, water column, auxiliary low water cut-off, steam gauge, vent, safety valves, feedwater, and continuous blowdown.
- The upper drum includes a feedwater distribution pipe and a blowdown collection pipe.

#### Lower (Water) Drum

- Inside diameter is 24 inches
- All connections larger than 2" to be flanged.
- External connections consist of chemical feed and intermittent blowdown.
- The intermittent blowdown connection is at the lowest point for draining of the unit
- The lower drum includes a chemical distribution pipe

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#### **1.4 Tubes**

1. All tubes enter the drum radially with full parallel bearing through the drum plate
2. All tubes are full diameter tubes with no swaging
  - Front Wall, Rear Wall, Furnace Floor, Sides, & Roof: 2" O.D., 0.150" M.W., SA-178 Grade A
  - Convection: 2" O.D., 0.120" M.W., SA-178 Grade A
  - Outer Side Wall: 2" O.D., 0.150" M.W., SA-178 Grade A

#### **1.5 Boiler Wall Construction**

**Front, Rear & Side Walls**

- Tube & Membrane
- 2" O.D. tubes,  $\frac{1}{4}$ " thick carbon steel membrane welded to each tube
- 3" 1200°F insulation
- Ribbed Aluminum

**Furnace Side Walls**

- Tube & Membrane
- 2" O.D. tubes,  $\frac{1}{4}$ " thick carbon steel membrane welded to each tube

**Drum Insulation & Lagging**

- 2", 1200°F Blanket
- 22 GA, carbon steel lagging, prime & finish painted
- Drum Heads: uninsulated

#### **1.6 Furnace Access and Observation Ports**

The Keystone furnace is accessible through one (1) 12" x 16" rear wall access door. The rear wall also includes two (2) 3" diameter air cooled observation port.

#### **1.7 Steam Purification**

The Keystone upper (steam) drum includes steam purifiers. The steam purifiers include a dry pan and a baffle.

#### **1.8 Structural Base and Lifting Lugs**

The Keystone includes a rigid structural steel base frame designed to distribute the loads onto a flat concrete foundation. The boiler is designed to be anchored at the front (anchor bolts are required and supplied by others) with thermal expansion towards the rear. Two top pick lifting lugs allow lifting from a single crane with a simple inverted V rigging arrangement.

#### **1.9 Piping, Trim and Accessories**

- Water level piping to water column and auxiliary water cutout
- Drain piping for water column water gauge glass, auxiliary cutout, and pressure gauge drain to approximately four (4) feet above boiler base.
- Steam pressure piping to pressure gauge
- The rear wall two (2) 3" diameter air cooled observation port.
- Sootblower steam supply and drain piping.
- Feedwater stop and check valves and 3-valve bypass for control valve